

REMARKS:

Substitute Specification

Applicants hereby submit the substitute specification attached at Tab A. The corrections made to the specification are to correct grammatical inconsistencies and improve syntax and thus believed to include no new matter. To comply with 37 C.F.R. §1.125(b)(2), Applicants also submit a marked-up copy of the substitute specification attached at Tab B showing the matter being added to and the matter being deleted from the specification of record.

New Claims 22-55

In the above amendment, Applicants have replaced the claims of record with new sets of claims 22-55. The assignee of this application has been reviewing its business plans and has found that old claims 1-21 may not be extensive enough to protect some of the assignee's planned businesses. For the reasons set forth below, the subject matters recited in the new claims are fully supported by the disclosure of the specification. Please note, however, that the following discussions are to exemplarily show the claim supports in the specification for the Examiner's convenience and should not be construed in any way to limit the scope of the new claims.

Fig. 2. is one of the representative drawings showing the embodiment of the present invention. In the drawing, the GWS 5 relays application data between the MS 1 and the CPS 8. The GWS 5 is an important constituent of the wireless communication network that serves the MS 1. The GWS 5 communicates with the CPS 8, using TCP/IP. It also communicates with the MS 1, using a special communication protocol dedicated to the wireless telecommunication. More specifically, the bottom three layers perform control and management of wireless telecommunication. The functions of the bottom three layers are discussed in detail in paragraphs 45-50 in the substitute specification.

A transport layer, the fourth layer, is located on the three layers. This forth layer is also dedicated to the wireless telecommunication and sets up one or more logical connections between the MS 1 and the GWS 5. Please note that as shown in Fig. 2, the wireless telecommunication link established by these four layers between the MS 1 and the GWS 5 terminates at the GWS 5. On the other hand, in addition to the wireless telecommunication link with the MS 1, the GWS 5 has an independent communication

link with the CPS 8 which also terminates at the GWS 5. Since the wireless telecommunication like between the MS 1 and the GWS 5 and the communication link between the CPS 8 and the GWS implement the different communication protocols, the GWS 5 performs communication protocol conversions on data relayed between the MS 1 and the CPS 8.

New claim 22 recites "establishing a packet communication link between the first node and the network that implements packet communications between the first node and the network". This step is discussed in detail in paragraphs 57-60 of the substitute specification.

Claim 22 also recites "establishing, over the packet communication link, one or more logical communication connections between the first node and the network in order to communicate the application data between the first node and one or more second nodes". After the bottom three layers establish the packet communication link between the MS 1 and the GWS 5, the forth layer establishes a logical connection between the MS 1 and the GWS 5 on the packet communication link. The procedures for establishing the logical connection are discussed in detail in paragraphs 62-67. Specifically, the specification states in paragraph 67,

"With the simplified protocol TL, the capabilities (the above-mentioned communication parameter values) of the MS 1 and the GWS 5 (the partner sides) are negotiated before setting up the logical connection and prior to data exchange.....A logical connection is then established between the MS 1 and the GWS 5 by means of these operations."

The logical connection is established for communication between the MS 1 and the CPS 8. But it terminates at the GWS 5. In other words, there is no logical connection established throughout between the MS 1 and the CPS 8.

Claim 22 lastly recites "while relaying the application data between the first node and the one or more second nodes, conducting at the network communication protocol conversions on the application data to be sent to the first node and received therefrom". The detailed procedures for exchanging data through TCP/IP between the GWS 5 and the CPS 8 are discussed in paragraphs 70-72. On the other hand, the application data received from the CPS 8 is reloaded on the wireless communication protocol and sent

to the MS 1 (paragraph 74). In relaying the application data from the CPS 8 to the MS 1, the GWS 5 performs the communication protocol conversions.

Claim 23 recites a registration step. Claims 24-26 recite an authentication step. These steps are discussed in paragraph 58.

Claim 27 recites registration of a packet communication. This step is discussed in paragraph 59.

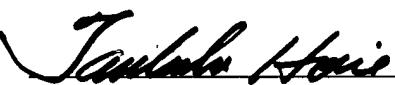
Claim 31 recites a connection setup request for initiating establishing a logical connection. This is discussed in paragraph 63.

Claim 32 recites "wherein the logical communication connection ensures delivery of application data between the first node and the network". As discussed in paragraphs 66 and 75, a delivery of data on the logical connection results in a return of ACK. In other words, the MS 1 and the GWS 5 are waiting to receive an ACK from the other to make sure that data has been delivered to the other.

Office Action

In the Office Action, the Examiner rejected claims 1-21 under 35 U.S.C. 103 as being unpatentable over Chuah et al (U.S. Patent No. 6,115,390) in view of Farris (U.S. Patent No. 6,546,003). Neither of the references discloses or teaches the inventions recited in new claims 22-55.

Respectfully submitted,



Tadashi Horie
Registration No. 40,437
Attorney for Applicant(s)

BRINKS HOFER GILSON & LIONE
P.O. Box 10395
Chicago, IL 60610
(312) 321-4200



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~~COMMUNICATION CONTROL METHOD, COMMUNICATION METHOD, SERVER APPARATUS, TERMINAL DEVICE, RELAY APPARATUS AND COMMUNICATION SYSTEM FOR MOBILE DEVICES~~

RECEIVED

5

BACKGROUND OF THE INVENTION

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TECHNICAL FIELD

Technology Center 2100

10 The present invention relates to a ~~communication control method, communication method, server apparatus, terminal device, relay apparatus and communication systems and more particularly to a communication system suitable for use in an information distributing distribution system providing information from at least one server apparatus to~~
15 a plurality of user terminals via a network.

BACKGROUND ART

20 The ~~i~~Internet provides content providers with an environment capable of ~~providing~~ ~~delivering~~ content to users around the world directly and at a low cost, ~~-. In addition, the Internet and provides users an environment that allows enabling content from around the world to be enabled for use used in a standard user interface. Along with the popularization of the internet, r~~ Recent years have seen active ~~As~~ development, provision and use of content providing services ~~that makeing~~ use of the ~~i~~Internet ~~become more prevalentaetive~~, and the vast amount of content available ~~for various uses on the ~~i~~Internet is increasing~~ daily. As a result, the ease of access to the ~~i~~Internet has become an important consideration in the development of content ~~distributing~~ ~~distributing~~ services.

With the spread ~~increasing~~ popularity of the

5 ~~Internet, transparent system architectures employing internet technologies within LANs (Local Area Networks) have become commonplace. Here, one basic constituent of many "Internet technologies" is the communication protocol, specifically TCP/IP (Transmission Control Protocol / Internet Protocol). That is, In fact, a very large number of networks currently employ the TCP/IP.~~

10 ~~Data communications according to TCP/IP are based on an OSI layer model (OSI Reference Model). The OSI reference model is a seven layer model used to model data relayed between a transmitter and a receiver. wherein, on the transmission side, data is relayed by sequentially subsequently adding headers for each layer on to actual data from a higher layer to a lower layer, and to form packets.~~

15 ~~The packets are transmitted to the reception side. On the other hand, at the reception side, the transmitted packets are handed processed sequentially subsequently from the lowest physical layer (physical layer) in order to the highest layer. During processing this procedure, in each~~

20 ~~layer, packets supplied from a lower layer are separated into data and a header corresponding to that layer, - the content of this the header is analyzed, and the data is handed to a next higher layer.~~

25 ~~An example of the Here, the packet structure obtained by the processing in each layer on the transmission side shall be explained with reference to Figs. 12-14. However, it shall here be assumed that, as in general dial up connections, In this example, the transmission side and reception side are connected one-to-one using a PPP (Point-to-Point Protocol) -, as in general dial-up connections.~~

30 ~~Fig. 12 shows the structure of a an example TCP segment which is a packet that has undergone processing in the fourth layer (transport layer) . This The TCP segment~~

is composed of a TCP header and data. Here, the The TCP header is composed of a basic header (20 bytes) and an optional header. The basic header includes information such as a source port number, destination port number, 5 sequence number, acknowledgment number, code bits and window size. Additionally, the data is composed of actual data and a header added by ~~means of~~ processing ~~of~~ ~~at~~ an upper layer equal to or higher than the fifth layer (session layer).

10 Fig. 13 shows the structure of an example IP datagram which is a packet that has undergone processing in the third layer (network layer). This The IP datagram is composed of an IP header and data. Here, the The IP header is composed of a basic header (20 bytes) and an optional 15 header. The basic header includes information such as a source IP address, a destination IP address, a service type, a packet length, and a protocol number. Additionally, the data is composed of actual data and a header added by processing at least on a ~~elayer~~ equal to or higher than the 20 fourth layer (transport layer) ~~of an upper layer (such as~~ TCP, UDP (User Datagram Protocol) or ICMP (Internet Control Message Protocol) ~~.)~~ including at least one layer equal to ~~or higher than the transport layer~~.

25 Fig. 14 shows the structure of an example PPP frame which is a packet that has undergone ~~the~~ processing of in the second layer (data link layer). The numbers in parentheses in the drawing Fig. 14 are given in units of bytes. This The illustrated PPP frame consists of a PPP header (5 bytes), data, and a PPP footer (3 or 5 bytes). 30 Here, the The PPP header is composed of various information such as includes a flag, an address, a control, and a packet protocol identifier such as (LCP (Link Control Protocol), IPCP (Internet Protocol Control Protocol), IP

or IPX (Internetwork Packet Exchange) --. Additionally In addition, the data ~~is composed of~~ includes actual data and a header (including the above-mentioned TCP header and IP header) added by processing at a layer including at least one layer equal to or higher than the third layer (network layer). The PPP footer ~~is composed of~~ includes an FCS (Frame Check Sequence) and a flag. The MTU indicated in Fig. 14 the drawing refers to the maximum transmission unit.

As described above, on the transmission side, the actual data to be transmitted is processed by procedures corresponding to each layer in the OSI layer model from the highest layer to the lowest layer. As such, so that a header corresponding to the processing of each layer is sequentially added to the actual data.

In Fig. 7 illustrates an example, 7A is a packet 7A that has undergone all of the processes on the transmission side and finally is ready to be transmitted. As such that, as shown in Fig. 7 the drawing, the packet 7A has a header composed of a 5-byte PPP header, a 20-byte IP header and a 20-byte TCP header. for a The header with therefore includes a total of 45 bytes that are added to the head at the beginning of the application data (if it is assumed that there are no optional headers). In addition, and a 3- or 5-byte footer is added to the tail at the end of the application data. The size of the application data is, for example, 500 bytes and can be expanded to a maximum of 1460 bytes.

Next, the The operating sequence for the case of performing packet communications according to TCP/IP shall now be explained with reference to the example process flow diagram of Fig. 15.

First, At S1, an LCP set up request message requesting set up of the LCP (LCP set up request) is sent

from the data transmission side to the data reception side, or from the data reception side to the data transmission side. (S1). Next, an An acknowledgment response message (LCP Set Up Ack) with respect corresponding to the LCP set up request is then sent from the party receiving the LCP set up request message to the other side (S2). At S3, Subsequently, a Challenge Message to for performing identification at the other side is subsequently sent from the data reception side. (S3), and upon Upon receipt of this the challenge message on the data transmission side, a response message is sent out (S4) at S4. Then, a At S5, a Success Message to the effect indicate that the identification on the other side has succeeded is then sent out from the data reception side to the data transmission side. (S5).

Once this sequence of operations is completed, an IPCP set up request message is sent from the data reception side to the data transmission side at S6 (S6). Furthermore In addition, an IPCP set up request message is sent from the data transmission side to the data reception side at S7 (S7).

Then At S8, an IPCP set up request message or a negative response message (Nak) is sent from the data reception side to the data transmission side (S8). Upon receiving this, an acknowledgment response message with respect to the receiving the IPCP set up request message, an acknowledgement response message (IPCP Set Up Ack) is sent from the data transmission side (S9) at S9.

Then, this time At S10 an IPCP set up request message is then sent from the data transmission side to the data reception side (S10). Upon receiving this the IPCP set up request message, an acknowledgment response message with respect to this IPCP set up request is sent from the data

reception side at S11-(S11).

— In this way, a PPP link is established between the data transmission side and the data reception side.

5 Next, At S12, an IP + TCP Request a message (IP + TCP Request) requesting establishment of an IP data link and establishment of a TCP connection is then sent from the data transmission side to the data reception side (S12). When Upon receipt of the IP + TCP request message, an IP + 10 TCP acknowledgment response message with respect to this message is sent from the data reception side at S13. At S14, the data transmission side receives the IP + TCP acknowledgement response message and (S13), the data transmission side upon receiving this sends out a reply an IP + TCP acknowledgment response message to the effect indicating that this the IP + TCP acknowledgment response message has been received (S14).

15 — In this way, a TCP connection is established between the data transmission side and the data reception side. —, and the The transmission and reception of actual data in 20 the form of packet data is then initiated. — as described below.

First, when packet Packet data is first transmitted from the data transmission side by means of HTTP (HyperText Transfer Protocol) at S15. (S15), At S16, the data 25 reception side, upon receiving receives the packet data and this, sends out an acknowledgment response message. (S16). Then, in accordance with the depending on the size of the data being transmitted (e.g. the number of packets needed), the operations of steps S15 and S16, i.e. the 30 operations of transmitting the packets and sending back to the data transmission source an acknowledgment response message to the effect that the packets have been received without problems are repeatedly performed until, and the

transmission of the packet data is ultimately completed (S17).

When At S17, a transmit finish message indicating to the effect that the transmission of the packet data has been completed is sent out from the data transmission side. The data reception side, upon receiving the transmit finish message, which has received this sends out an acknowledgment transmit finish response message at S18. (S18). Then, this time At S19 a reception complete message to the effect that the reception of data has been completed is sent out from the data reception side. Upon receipt of the reception complete message, which the data transmission side sends out an acknowledgment reception complete response message at S20.

In this way, the TCP session is terminated.

Next, in At terminated. At S21, to disconnect disconnecting the PPP link, a Termination Request message requesting termination of the PPP link (Terminate Request) is sent out from the data transmission side (S21). Upon receiving the termination request message this, an acknowledgment termination request response message is sent from the data reception side at S22 (S22).

In this way, the PPP TCP link is first disconnected. and upon Upon disconnection of the PPP link, the channel is disconnected cut off at S23 (S23) and the overall operation is completed.

In recent years, mobile communications have spread widely, and mobile data communications using mobile terminals is increasing rising should also see a rise in popularity. In the field of mobile data communications, it has become possible for a mobile user to access the internet Internet using a mobile terminal, and the Accordingly, provision of for user-friendly internet

Internet access services for mobile users is has been desired. However, when providing Providing such mobile Internet internet access services using packet communications according to TCP/IP as described above, 5 however, creates undesirable undesirable performance and operability issues. —the problems mentioned below arise, making them as difficult to handle as mobile stations (portable telephones), and mobile terminals capable of readily accessing the internet did not exist.

10 First, withWith TCP/IP, as described above, the header of a packet is added sequentially by each the layer and encapsulated. —, as As a result, of which the overall header size becomes extraordinarily large. —, and particularly The header size is particularly large in 15 comparison to the data when the actual data size is small. —. the relative header size becomes large. —For example, when transferring about 500 bytes of data during mobile communications, the header size comes to is about ten percent of the data size. —, and there are fields among 20 Among the information contained in the header there are also fields which are left absolutely unused. —in actuality.

Next, there is a problem in that the The number of signals exchanged between the data transmission side and 25 reception side using TCP/IP is also relatively extremely large in the operating sequences during establishment of connections prior to actually transmitting the data. In the example shown in Fig. 15, a total of 14 steps from step S1 to S14 are performed required. Consequently, as the 30 number of users accessing a the network increases, the network traffic increases dramatically and the data transfer rates may drops. —In addition, —Additionally, since the mobile user is charged for

the operations (steps S1-S14) prior to data transmission and reception, the economic burden on the mobile user side may also becomes large.

5 Although these problems-processes also occur in connections to the internet-Internet via fixed networks, they are especially burdensome serious problems in mobile communications-communication where wherein the data transmission ability-capability (e.g. bandwidth) is relatively low in comparison to communications- via fixed 10 networks.

15 Additionally In addition, since the TCP/IP is relatively complex too heavy, it makes the mobile terminals with available computing capability having the ability to rapidly process the TCP/IP may ust be larger, heavier, and more expensive. than the mobile station, when installing deviees with the ability to process data to the level of mobile stations. Currently, such the large, heavy and expensive mobile terminals with rapid processing capability (such as a personal digital assistant (PDA), etc.) which simply includetegrate a portable computer with a mobile station and are therefore received well only in small markets. In contrast, mobile stations that are used for voice communication are stations are designed with for portability, operability and ease of use. The obtainment in mind, and the form and price of mobile stations for voice communication are believed to be already be well- received in an extremely a broad market due to their general usefulness and high degree of popularity.

20 Additionally, as

30 As mentioned above, various types of content capable of responding to meeting the needs of various users already exists on the Internet. internet, and due Due -to the steady increase in the amount of content, even now, devices

which that are already operated capable of being accepted by various users such as mobile stations for voice communication are desired as devices for accessing the internet Internet. Keeping With these points matters in mind, there is little doubt probability Thus, that services for accessing the Internet internet using mobile terminals stations for voice communication that haveing the ability capability to rapidly process TCP/IP will be well-received in a wide market. Even, even without taking into consideration the problem of data transmission ability capability in mobile communications.

Of course, one One might also consider having the content providing side develop content which that is customized to the data processing power of mobile stations for voice communication, and/ or the data transmission capabilityability of mobile communications. The, but this type of development of this type of customized content may placerequires a heavy burden of on the content providing side. and Accordingly, it is predicted that only a small amount of content with uses that are restricted to mobile stations for voice communication as compared to the content of the internet Internet will be available able to be provided to the user. That is, it is believed that this type of experiment would only be well received in a small market.

From the above description, it is believed that the foundation of mobile data distribution is in the combination of mobile stations with voice communication with the Internet. In internet, and in order to achieve this combination, it is necessary to develop efficient communication technologies which enable mobile users to effortlessly stresslessly use content from the Internet internet using mobile stations with voice communication.

SUMMARY OF THE INVENTION

The present invention has been made in view of the
5 above-mentioned problems, and has the object of providing a
communication control method, communication method, server
apparatus, terminal device, relay apparatus and
communication system capable of efficiently performing data
communications even when the data processing capability
10 ability and transmission capability ability are not high
such as in mobile stations.

In order to achieve the above purpose, a
communication control method recited in claim 1 is a
communication control method in a relay apparatus for
15 relaying data communications between a server apparatus and
a user terminal. The method comprises, comprising a step
of receiving a packet that includes containing a request
message to request requesting establishment of a connection
with the server apparatus and an identification number for
20 the connection. The request message is sent from the user
terminal according to a first communication protocol.

The method also includes which is a protocol; a step
of transmitting a packet containing an acknowledgment
response message that the packet has been received to the
25 user terminal according to the first communication protocol.
The acknowledgement response message is indicative that the
request message has been received by the relay apparatus.
In addition, the method includes, and establishing a
connection between the server apparatus and the relay
30 apparatus itself according to a second communication
protocol, wherein the first communication protocol is
simpler than the second communication protocol.

The method further includes; a step of receiving a

packet containing a data transfer request message transmitted from the user terminal to the server apparatus according to the first communication protocol, and transmitting a packet containing the ~~this~~ data transfer request message to the server apparatus according to the second communication protocol. In addition, the method includes; and a step of receiving includes receiving data transmitted from the server apparatus according to the second communication protocol and transmitting a packet containing ~~this~~ the received data to the user terminal according to the first communication protocol. Here, the first communication protocol is simpler than the second communication protocol.

According to this communication control method, a conversion is made between a second communication protocol with a server apparatus and a first communication protocol with a user terminal. The first communication protocol which is simpler than the second ~~this~~ communication protocol. The second communication protocol may be used to directly relay when relaying client ~~client/~~ relay client /server type data communications between a user terminal and a server apparatus. Consequently, according to this communication control method, at least one of the following is achieved on the user terminal side: a reduction of the size of the headers ~~header~~ in the packets, a reduction in the ~~of~~ number of messages ~~(signals)~~ exchanged, and a reduction in ~~of~~ processing at the user terminal. Accordingly, thereby enabling the ~~processing~~ load on the user terminal side to be ~~is~~ lightened.

—In particular, since ~~—~~ much of the message content exchanged over the Internet ~~internet~~ is text data. In ~~and~~ in ~~the~~ transmission of text data according to TCP/IP, the proportion of actual data in the transmitted packets is low.

When, so that when considering connections to the Internet, the reduction of the headers in the packets is extremely effective.

Additionally, a communication control method recited 5 in claim 2 is a communication control method in a relay apparatus for relaying data communications between a server apparatus and a user terminal. The method comprises, comprising a step of receiving a packet that includes containing a request message requesting to request 10 establishment of a connection with the server apparatus, an identification number for the connection and a data transfer request message for the server apparatus. The request message is transmitted from the user terminal according to a first communication protocol.

15 The method also includes, a step of transmitting a packet containing an acknowledgment response message that the packet has been received to the user terminal according to the first communication protocol. The acknowledgement response message indicates that the request message has 20 been received by the relay terminal. In addition, the method includes establishing a connection between the server apparatus and itself—the relay terminal according to a second communication protocol.

25 The method further includes, and transmitting a packet containing the data transfer request message to the server apparatus, and a step of receiving data transmitted from the server apparatus according to the second communication protocol and transmitting a packet containing this—the received data to the user terminal 30 according to the first communication protocol. Here, the The first communication protocol is simpler than the second communication protocol.

According to this communication control method, it is

possible to include a connection establishment request to the server apparatus and a data transfer request in a single message (signal) from the user terminal to the relay apparatus. As a result, ~~according to this communication control method~~, the traffic between the user terminal and relay apparatus can be reduced and data transfer requests can be sent ~~out to the relay apparatus without the user terminal~~ waiting for acknowledgment response messages from the relay apparatus. ~~at the user terminal, in~~ In addition, methods similar to those previously discussed with regard to claim 1 are also described. ~~to the effects of the invention recited in claim 1.~~

A communication control method recited in claim 3 is the a-communication control method according to claim 1 or 2, wherein the number of messages the (signals) used in establishing the connection between the user terminal and the relay apparatus according to the first communication protocol is less than the number of messages signals used in establishing the connection between the relay apparatus and the server apparatus according to the second communication protocol.

According to this communication control method, it is possible to reliably reduce the number of messages signals exchanged by the user terminal when establishing a connection, in addition to the method effects due to the invention recited in claim 1 or 2.

A communication control method recited in claim 4 is the a-communication control method according to claim 1 or 2, wherein a communication interval path between the user terminal and the relay apparatus - is composed of a wireless communication path. A of a radio oriented interval, and a communication interval path between the relay apparatus and the server apparatus, on the other hand, is composed of a

wireline communication path a wire-oriented interval.

According to this communication control method, communications by a wireless communication protocol that is simpler than the communication protocol in wireline 5 communications is a wired interval are performed over a wireless communication paths. As previously discussed, wireless communications in a radio interval which generally have has a lower data transmission capacity than wireline communications the wired interval. Therefore, according to 10 this communication control method, the effect of being able to achieve communications suited to the data transmission capabilities of each interval path is obtained in addition to the method effects according to the invention recited in claim claims 1 or 2.

15 A communication method recited in claim 5 is a communication method for performing data communications between a server apparatus and a user terminal, wherein a communication control procedure in an upper layer includes containing a transport layer in the data communications. 20 The method comprises a first step of transmitting from the user terminal to the server apparatus a first packet containing a request message to request requesting establishment of a connection and an identification and an identification number for the connection.

25 from the user terminal to the server apparatus; a second step of In addition, the method includes transmitting from the server apparatus to the user terminal a second packet containing an acknowledgment response message indicating that the this first packet has been received. from the server apparatus to the user terminal; and a third step of The method further includes transmitting a third packet containing actual data to the user terminal from the server apparatus by designation of

designating the identification number. The third packet is transmitted from the server apparatus after the connection has been established between the user terminal and the server apparatus.

5 According to this communication method, a connection is established between the user terminal and server apparatus. The connection is established by a communication control procedure of an upper layer that includes containing a transport layer. The , and the 10 transmission of packets containing actual data is performed through the this connection. Consequently, according to this communication method, at least one of the following is achieved on the user terminal side: a reduction in the size 15 of the headers header in the packets, a reduction in the of number of messages signals exchanged and a reduction in of processing. The method therefore allows, thereby enabling the allows the processing load on the user terminal side to be lightened.

20 The Here, the reduction The reduction of the processing load on the user terminal side shall now be explained using an example. In this example, in detail.

25 For example, a case where the user terminal and server apparatus commence communications using TCP/IP and PPP shall be assumed. Using existing TCP/IP and PPP protocols, In this case, there are the following problems:-:

1. The Since the communication protocols of each layer are for general use. Accordingly, the proportion of actual data contained in the transmitted data is extremely small due to encapsulation encapsulating in the layers.
2. Establishment Since establishment procedures are performed for each layer when establishing a connection. Accordingly, a large number of messages signals must be exchanged. thus increasing Communication traffic is

therefore increased, which and causing causes a great
greater processing load on the user terminal.

3. At the user terminal, data encapsulating and decapsulating procedures are performed over multiple stages,
5 | thus causing a great greater load on the user terminal.

In contrast, by transmitting packets containing actual data through connections established by the communication control procedures of the upper layers that include containing the transport layer as in the this 10 | communication method of claim 5, method, it is possible to resolve at least one of the above problems.

15 | Additionally, aA communication method recited in claim 6 is a communication method for performing data communications between a user terminal and a relay apparatus. The relay apparatus is —for relaying data communications between the user terminal and a server apparatus. The , wherein communication control procedure in an upper layer includes containing a transport layer. The method in the data communications comprises a first 20 | step of transmitting from the user terminal to the relay apparatus a first packet containing a message requesting establishment of a connection and an identification number for the connection.

25 | and an identification number for the connection from the user terminal to the relay apparatus; a second step of
The method also includes transmitting from the relay apparatus to the user terminal a second packet containing an acknowledgment response message that this—the first
packet has been received. from the relay apparatus to the user terminal; and a third step of The method further 30 | includes transmitting to the user terminal a third packet containing actual data supplied to the relay apparatus according to a predetermined protocol from the server

apparatus. ~~to the user terminal by~~ The third packet is transmitted by designating the identification number after the connection has been established between the user terminal and the relay apparatus.

5 According to this communication method, a connection is established between the user terminal and relay apparatus ~~through~~ by communication control procedures performed in ~~of~~ upper layers including the transport layer. ~~and~~ ~~pp~~ackets containing actual data from the 10 server apparatus are transmitted from the relay apparatus to the user terminal through this connection. Consequently, ~~According to this communication method, the same effects as those of the invention recited in claim 5 are obtained.~~ Additionally, ~~according to this communication method, the connection is first established between the user terminal and the relay apparatus. The time the user terminal has to wait to receive, thereby shortening the time until an acknowledgment response message becomes shorter, compared to cases where a connection is received at the user~~ 15 ~~terminal in comparison to the case where one is established between the user terminal and a server apparatus.~~

20

Also, a communication method recited in claim 7 is ~~the~~ ~~a~~ communication method according to claim 5, wherein in the first ~~packet~~ ~~step~~, the user terminal ~~also~~ transmits, to the server apparatus, data size information. The data size information indicates ~~ing~~ the maximum amount (size) of data that ~~the user terminal~~ ~~it~~ is capable of receiving ~~in one~~ ~~packet~~ ~~at once~~ to the server apparatus. ~~and t~~ The server apparatus obtains the maximum data size information from the first ~~packet~~ received. ~~data size information which has been received, and Based on the maximum data size, the server apparatus divides the actual data for transmission to the user terminal among two or more packets if the size~~ 25 30

of the actual data ~~third packet~~ exceeds the maximum data size.

According to this communication method, in addition to the effects of the invention method recited in claim 5, it is possible to avoid situations are avoided where the server apparatus sends the user terminal packets of data that are of a size too large enough for the user terminal to not be able to receive in one packet which cannot be received at once by the user terminal, in addition to the effects due to the invention recited in claim 5. In other words, transmitted data packets are sized less than or equal to a maximum size of data packets that the user terminal has indicated are capable of receipt by the user terminal.

Furthermore, a communication method recited in claim 8 includes the communication method according to claim 6, wherein in the first step, the user terminal transmits, to the relay apparatus, data size information indicating the maximum size of data that the user terminal it is capable of receiving in one packet. at once to the relay apparatus, and the relay apparatus obtains the maximum data size information from the received data size information which has been received, and divides the actual data for transmission to the user terminal if the size of the actual data ~~third packet~~ exceeds the maximum size.

According to this communication method, in addition to the effects of the invention method recited in claim 6, it is possible to avoid situations where the relay apparatus sends the user terminal packets of data that are sized larger than the user terminal is able to receive are avoided a size large enough for the user terminal to not be able to receive in one packet which cannot be received at once by the user terminal, in addition to the effects due

~~to the invention recited in claim 6.~~

A server apparatus recited in claim 9 is a server apparatus for performing data communications with a user terminal. The server apparatus comprises, comprising 5 communication control means for performing communication control at an upper layer level. The upper layer level that includes containing a transport layer when in order to performing the data communications. The communication control means further comprises means for receiving a 10 first packet containing a connection request message. The connection request message includes a that requesting to establishment of a connection with the server apparatus, and an identification number for the connection transmitted from the user terminal.

15 The communication control means also includes, means for transmitting, to the user terminal, a second packet containing an acknowledgment response message. The acknowledgement response message indicates that the first packet has been received by the server apparatus. 20 to the user terminal, and The communication control means further includes means for transmitting, to the user terminal, a third packet that includes containing actual data. to the user terminal The third packet may be transmitted by designation of the identification number, after the 25 connection has been established with the user terminal.

According to this server apparatus, the communication control is performed at an upper layer level that includes containing the transport layer. With this communication control, a connection is established between the server 30 apparatus and the user terminal, and packets containing actual data are transmitted from the server apparatus to the user terminal via the is connection. Consequently, this server apparatus is able to obtain achieve the same

effects as those of the effects due to the invention recited in claim 5.

A relay apparatus recited in claim 10 is a relay apparatus for relaying data communications between a server apparatus and a user terminal. The relay apparatus comprises ing communication control means for performing communication control. The communication control is performed at an upper layer level that includes containing a transport layer in order to when performing the data communications. Further comprises ing means for receiving a first packet containing a connection request message. The connection request message that includes a requests to requesting establishment of a connection and an identification number for the connection transmitted from the user terminal.

In addition, the communication control means includes means for transmitting to the user terminal a second packet containing includes an acknowledgment response message indicating that this first packet has been received by the server apparatus. Further, the communication control means includes and means for transmitting, to the user terminal, a third packet that includes containing actual data supplied from the server apparatus to the relay apparatus according to a predetermined protocol. The third packet may be transmitted to the user terminal by designation of the identification number, after the connection has been established between the user terminal and itself the relay apparatus.

According to this relay apparatus, communication control is performed at the upper layer level that includes containing the transport layer. With this communication control, a connection is established between the relay apparatus and the user terminal. through which,

and Packets containing actual data provided by from the server apparatus are transmitted from the relay apparatus to the user terminal through this connection.

5 Tconsequently, this relay apparatus is able to obtain achieve the same effects as those of the effects due to the invention recited in claim 6.

10 Additionally, a A relay apparatus recited in claim 11 is a relay apparatus for relaying data communications between a server apparatus and a user terminal. The relay apparatus , comprising means for receiving a packet containing a connection request message. The connection request message includes a that requests requesting to establishment of a connection with the server apparatus and an identification number for the connection. The connection request message may be transmitted from the user terminal according to a first communication protocol. The relay apparatus also comprises , means for transmitting , to the user terminal , a packet containing an acknowledgement response message. The acknowledgement response message is transmitted according to the first communication protocol and includes indication that the packet has been received by the server apparatus to the user terminal according to the first communication protocol , and

25 The relay apparatus also includes means for establishing a connection between the server apparatus and the relay apparatus itself according to a second communication protocol. The relay apparatus further also comprises , means for receiving a packet containing a data transfer request message. The data transfer request message is transmitted from the user terminal to the server apparatus according to the first communication protocol.

30 The relay apparatus also includes means , and for transmitting a packet containing the is data transfer

request message to the server apparatus according to the second communication protocol. The relay apparatus further comprises, and means for receiving data transmitted from the server apparatus according to the second communication protocol and means for transmitting a packet containing this data to the user terminal according to the first communication protocol. ; wherein tThe first communication protocol is simpler than the second communication protocol.

According to tThis relay apparatus performs , a conversion is made between the second a communication protocol used to communicate with thea server apparatus and a the first communication protocol used to communicate with a the user terminal. The first communication protocol is which is simpler than theis communication protocol that when relaysing client/server type data communications between a user terminal and a server apparatus.
Consequently, tThis relay apparatus is able to achieve obtain the same effects as those of the invention recited in claim 1.

Furthermore, a relay apparatus recited in claim 12 is a relay apparatus for relaying data communications between a server apparatus and a user terminal. The relay apparatus, comprises ing means for receiving a packet containing a connection request message that includes a request ing to establishment of a connection to the server apparatus and, an identification number for the connection. The means for receiving a packet may also receive and a data transfer request message for the server apparatus transmitted from the user terminal according to a first communication protocol.

The relay apparatus also includes , means for transmitting, to the user terminal, a packet containing an acknowledgment response message indicating that the packet

has been received by the server apparatus. The packet containing the acknowledgement response message is transmitted to the user terminal according to the first communication protocol. Means, for establishing a connection between the server apparatus and the relay apparatus itself according to a second communication protocol are also included in the relay apparatus.

In addition, and means for transmitting a packet containing the data transfer request message to the server apparatus, and means for receiving data transmitted from the server apparatus according to the second communication protocol are also included in the relay apparatus. The relay apparatus also includes means and for transmitting a packet containing this data to the user terminal according to the first communication protocol. , wherein the first communication protocol is simpler than the second communication protocol.

According to this relay apparatus, it is possible to include a connection establishment request to the server apparatus and a data transfer request may both be included in a single signal (or message) from the user terminal to the relay apparatus. Therefore, the relay apparatus is capable of achieving obtaining the same effects as the effects of the invention recited in claim 2.

A relay apparatus recited in claim 13 is a relay apparatus according to claim 11 or 12, wherein the number of signals used for establishing the connection between the user terminal and the relay apparatus according to the first communication protocol is less than the number of signals used in establishing the connection between the relay apparatus and the server apparatus according to the second communication protocol.

According to this relay apparatus, the number of

signals exchanged at the user terminal when establishing a connection can be reliably reduced in addition to the effects of the invention recited in claim 11 or 12.

A relay apparatus recited in claim 14 is a relay apparatus according to any one of claims 10-12, wherein a communication interval-path between the user terminal and the relay apparatus ~~is composed of~~ includes a wireless communication path (radio-oriented interval). In addition, and a communication path ~~interval~~ between the relay apparatus and the server apparatus ~~is composed of~~ includes a wireline communication path (wire-oriented interval).

According to this relay apparatus, the communication procedures in the wireless communication ~~a radio interval path~~ which generally ~~have~~s a lower data transmission capacity than ~~a~~ the wireline communication ~~a~~ interval-path. The communication procedures in the wireless communication path are ~~is~~ reduced to less than the communication processes necessary to achieve communications on ~~in~~ the wireline communication ~~a~~ interval path. Consequently, ~~according to t~~his relay apparatus, the effect of being able to achieve communications suited to the data transmission capabilities of each interval-communication path, ~~is obtained~~ in addition to the effects of ~~according to~~ any one of claims 10-12.

A communication system recited in claim 15 is characterized in that a user terminal and a server apparatus are connected via a relay apparatus according to any one of claims 10-12.

According to this communication system, the same effects as ~~those~~ the same effects of any one of claims 10-12 can be achieved~~obtained~~.

A terminal device recited in claim 16 is a terminal device for performing data communications with a server

apparatus. The terminal device, comprising ~~sing~~ communication control means for performing communication control on an upper layer level ~~that includes~~ containing a transport layer ~~when in order to performing~~ the data communications, and the 5 communication control means comprises ~~sing~~ means for transmitting a first packet ~~that includes~~ containing a connection request message to ~~that~~ requests ~~sing~~ establishment of a connection with the server apparatus, and an identification number for the connection.

10 The communication control means also includes, and means for receiving a second packet containing an acknowledgment response message ~~that the first packet has been received~~ transmitted from the server apparatus. The acknowledgment response message includes indication that the first packet 15 has been received by the server apparatus, and means for receiving a third packet containing actual data transmitted from the server apparatus is also included in the communication control means. The third packet may be transmitted by first designating the identification number, 20 after the connection has been established with the server apparatus.

According to this terminal device, communication control is performed ~~at~~ ~~on~~ the upper layer level ~~that~~ includes containing the transport layer. With this 25 communication control, a connection is established between the server apparatus and the terminal device, and ~~p~~ Packets containing actual data are transmitted from the server apparatus to the terminal device through this connection. ~~Therefore, t~~ This terminal device is able to obtain ~~may also achieves~~ the same effects as ~~those of~~ the 30 invention recited in claim 5.

The terminal device recited in claim 17 is a terminal device for performing data communications with a server

apparatus via a relay apparatus. The relay apparatus that for manages ing a connection with the terminal device. The terminal device, comprises ing communication control means for performing communication control at on an upper layer level that includes eontaining a transport layer in order to when performing the data communications. + The communication control means comprises ing means for transmitting a first packet containing a connection request message that includes a request ing to establishment of a connection with the relay apparatus and an identification number for the connection.

The communication control means also includes + means for receiving a second packet containing an acknowledgment response message transmitted from the relay apparatus. The acknowledgment response message includes indication that the first packet has been received by the server apparatus. transmitted from the relay apparatus, and m Means for receiving a third packet containing actual data supplied from the server apparatus to the relay apparatus according to a predetermined protocol is also included in the communication control means. The third packet may be and transmitted from the relay apparatus by designating the identification number, after the connection has been established between the relay apparatus and itself.

According to this terminal device, communication control is performed on at the upper layer level that includes eontaining the transport layer. With this communication control, a connection is established between the relay apparatus and the terminal device. through which, and Packets containing actual data from the server apparatus are transmitted to the terminal device through this connection through this conneetion. Therefore, this terminal device is able to obtain also achieves the

samesimilar effects as those of the invention recited in claim 6.

The terminal device recited in claim 18 is a terminal device for performing data communications with a server apparatus via a relay apparatus. that for The relay apparatus managesing a connection with the terminal device. The terminal device, comprisesing means for transmitting a packet containing a connection request message that includes a request to ing establishment of a connection with the server apparatus and an identification number for the connection. The packet is transmitted according to a first communication protocol.

M, means for receiving a packet containing an acknowledgment response message that the packet has been received transmitted from the relay apparatus according to the first communication protocol is also included in the terminal device. The acknowledgment response message includes indication that the packet has been received by the server apparatus. The terminal device also includes means for transmitting a packet containing a data transfer request message to the server apparatus according to the first communication protocol.

M, and means for receiving according to the first communication protocol a packet containing actual data supplied from the server apparatus according to the first communication protocol is also included in the terminal device. The data supplied from the server apparatus is transmitted to the terminal device from the relay apparatus. The to the relay apparatus is supplied data from the server apparatus according to a second communication protocol in response to the data transfer request message. Here, t The first communication protocol is simpler than the second communication protocol.

According to this terminal device, a conversion is made at the relay apparatus between the second a communication protocol used to communicate with thea server apparatus and the firsta communication protocol used to 5 communicate with thea terminal device. The first communication protocol which is simpler than theis communication protocol needed to be performed when relaying client/server type data communications between a terminal device and a server apparatus. Therefore, this terminal 10 device is able to also achieve obtain the same effects as those of the invention recited in claim 1.

A terminal device recited in claim 19 is a terminal device for performing data communications with a server apparatus via a relay apparatus. The relay apparatus -that 15 for managesing a connection with the terminal device. The terminal device,- comprisesing means for transmitting according to a first communication protocol a packet that includescontaining 20 a connection request message tothat requestsing establishment of a connection with the server apparatus, an identification number for the connection and a data transfer request message for the server apparatus.

The terminal device also includes , means for receiving a packet containing an acknowledgment response message that this packet has been received transmitted 25 that is transmitted from the relay apparatus according to the first communication protocol. The acknowledgment response message includes indication that the packet was received by the server apparatus. , and Means for receiving according to the first communication protœol a 30 packet containing actual data supplied from the server apparatus transmitted according to the first communication protocol is also included in the terminal device. The packet containing actual data supplied from the server

apparatus is transmitted to the relay apparatus according to a second communication protocol in response to the data transfer request message. Here, ~~t~~ The first communication protocol is simpler than the second communication protocol.

5 According to this terminal device, ~~it is possible to~~ include a connection establishment request to the server apparatus and a data transfer request may both be included in a single signal (signal (message)) from the user terminal to the relay apparatus. Therefore, this terminal device is
10 ~~able to obtain~~ also achieves the same effects as those of the invention recited in claim 2.

15 A terminal device recited in claim 20 is the a terminal device according to claim 18 or 19, wherein the number of signals used for in establishing the connection between the user terminal and the relay apparatus according to the first communication protocol is less than the number of signals used for in establishing the connection between the relay apparatus and the server apparatus according to
20 the second communication protocol.

25 According to this terminal device, it is possible to reliably reduce the number of signals exchanged when establishing a connection, in addition to the effects of the invention recited in claim 18 or 19.

30 A terminal device recited in claim 21 is the a terminal device according to any one of claims 17-19, wherein a communication interval path between the user terminal and the relay apparatus is ~~composed of~~ includes a radio oriented wireless communication interval path. In addition, ~~and~~ a communication interval path between the relay apparatus and the server apparatus is ~~composed of~~ includes a wireline communication oriented interval path.

According to this terminal device, the communications procedures in a wireless communication radio interval path

which generally have a lower data transmission capacity than a wireline communication interval path. The communication procedures in the wireless communication path are reduced to less than the communication procedures in the wireline communication & interval path. Therefore, according to this terminal device, it is possible to achieve communications suited to the data transmission capabilities of each interval link communication path, in addition to the effects of any of claims 17-19.

In summary of the above, the present invention since employing a simplified protocol when performing data communications between a server apparatus and a user terminal. The simplified protocol makes the header size smaller and thus in order to reduces the amount of data transferred. In addition the simplified protocol and reduces the number of transmitted messages (signals) when at a channel connection is established by employing a simplified protocol when performing data communications between a server apparatus and a user terminal. The present invention, thereby lightening reduces the communication traffic and reducing the resulting overhead and also improves the response of data communications. Therefore, it enables smooth and speedy downloading of the comfortable use of Internet contents with using devices having roughly the data processing capabilities of a mobile device and through wireless communication channels having relatively a low data transmission capacity.

30

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing the structure of an

example communication system according to an embodiment of the present invention.

Fig. 2 is a block diagram showing an example protocol structure of the same—communication system illustrated in Fig. 1.

Fig. 3 is a block diagram showing another example protocol structure of the same—communication system illustrated in Fig. 1.

Fig. 4 is a flow diagram showing an example the operating sequence prior to packet communications in the same—communication system illustrated in Fig. 1.

Fig. 5 is a flow diagram showing the—an example operating sequence during packet communications in the same—communication system illustrated in Fig. 1.

Fig. 6 is a flow diagram showing the—an example operating sequence after packet communications in the same—communication system illustrated in Fig. 1.

Fig. 7 is a table diagram comparing the structure of a packet transmitted in TCP/IP communications and the structure of a packet transmitted according to a simplified protocol T6 in the same embodiment.

Fig. 8 is a table diagram showing the structure of an example packet transmitted in a connection set up request in the same embodiment.

Fig. 9 is a table diagram showing the structure of an example packet transmitted in acknowledgment response to a connection set up request of Fig. 8 in the same embodiment.

Fig. 10 are is tables a diagram showing the structure of example a packets transmitted during data transmission and reception in the same embodiment, showing the structure of a packet containing actual data and showing the structure of a packet transmitted in acknowledgment response when at the — packet containing actual data has been

transmitted.

Fig. 11 is a diagram showing an example of the outward appearance of a mobile station contained in the same-communication system of Fig. 1 and showing a screen of 5 an information display portion when the mobile station is providing the user with information.

Fig. 12 is a table diagram showing the format of an example TCP segment.

10 Fig. 13 is a table diagram showing the format of an example IP datagram.

Fig. 14 is a table diagram showing the format of an example PPP frame.

15 Fig. 15 is a flow diagram showing an example operating sequence for the case in which data communications are performed using TCP/IP.

Fig. 16 is a block diagram showing the structure of another example communication system according to a modification example of the same embodiment.

20 DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferable mode for carrying out the present invention shall be described in detail with reference to the attached drawings.

25

1. Structure of Embodiment

1.1. System Structure

Fig. 1 shows the structure of a communication network 30 system of the present embodiment.

— ThisThe —communication network system comprises at least one MS (Mobile Station) 1, at least one BS (Base Station) 2, at least one PPM (Packet Processing Module) 3,—

and at least one GWS (GateWay Server) 5. At least one, CPS (Content Provider Server) 8 is connected to the GWS 5 via the Internet internet-6 or a dedicated line 7. In addition, at least one and M-SCP (Mobile Service Control Point) 9 is connected with the GWS 5.

BS 2, PPM 3, GWS 5, M-SCP 9 and the interconnecting communication paths lines for connecting these form a mobile packet communication network 10.

MS 1 is a terminal device which utilizes receives packet communication services of the mobile packet communication network 10. In addition to wirelessly communicating with being connected to the mobile packet communication network 10 shown in Fig. 1, the MS 1 is connected to may also wirelessly communicate with a mobile telephone network which is (not shown), whereby it is The MS1 may therefore also be capable of receiving a mobile telephone service.

Fig. 11 shows an example of the outward appearance of the MS 1 and a example screens displayed on the MS 1. The MS 1 has may include an audio input/output portion (not shown) for the user to perform audio communications. In addition, the MS 1 may include a radio portion for performing wireless radio communications with BS 2 (Fig. 1neither are shown). Further, the MS 1 may include, an information display portion 1a. The information display portion 1a may include be comprising a liquid crystal panel or the like.

An, an operating portion 1b may also be included in the MS 1 for performing information input operations such as number entry or character input. The MS 1 also includes, and an internal microcomputer for controlling these portions. Additionally, the MS 1 contains software that may be generally referred to as a browser for viewing

document data ~~data (a so-called browser)~~. ~~This~~ browser is software for displaying a dialog screen based on data in a HTML content format such as HTML data format. The data (hereafter referred to as HTML data) may be supplied from the CPS 8. The CPS 8 may be operated ~~possessed~~ by a content providing business to communicate content over ~~via~~ the mobile packet communication network 10.

5 The MS 1 may display ~~for the user~~ various types of information on the information display portion 1a utilizing ~~in accordance with~~ the above-mentioned browser. An example, and provides this information to the user. This ~~information~~ example information display portion 1a can display 8 (characters) \times 6 (lines) of information. In ~~other examples~~, ~~it is possible to have more than 8~~ characters horizontally and more than 6 lines vertically, ~~depending on the area of the information display portion 1a and the character size~~.

10 During operation ~~Next~~, an example of use of the MS 1 may perform a variety of functions and/or provide a variety of data. For example, ~~shall be explained with reference to~~ Fig. 11.

15 First, when the user pushes the ~~an~~ "information" key on the operating portion 1b, an initial screen 11A may ~~which~~ provides the user with information relating to a weather forecast. The initial screen 11A is displayed on the information display portion 1a. By operating a jog dial key 1c ~~in the center of the MS 1~~, the user can select from a weather forecast menu of "1"- "6" 5 in the initial screen 11A.

20 That is, if, ~~for example~~, the user selects "1", a screen 11B showing today's weather is displayed in the information display portion 1a.

If the user selects "2", then a screen 11C showing a

weekly weather forecast is displayed on the information display portion 1a. If the user selects "5", then a weather message submenu screen 11D is displayed. The weather message submenu screen 11D may be used to select, from which it is possible to obtain information select information such as a rainfall alarm or a quick weather report. Furthermore, if the user selects "6", then a world weather forecast screen 11E is displayed.

In this way, text Text-based information is may therefore be displayed on the information display portion 1a under control of the browser. The text-based information may be presented in a form that is easy for the user of the MS 1 to see and control.

In Fig. 1, the BS 2 may be are positioned according to a wireless radio zone. s which divide the ground e.g. into areas having a The wireless radio zone provides a communication area, such as a geographic area with a determined radius of such as about 500 meters. A BS 2 may and perform radio communications with one or more MS 1 that are present in the wireless these radio zones. In the mobile packet communication network 10, a plurality of the BS 2 may be geographically positioned to form a plurality of wireless radio zones.

The PPM 3 is a computer-based system provided that may operate in a packet subscriber switching station. The PPM 3 is capable of accommodating a plurality of BS 2. The PPM 3 may, which receives packet switching requests from the MS 1, via the BS 2. and In addition, the PPM 3 may relays packet switching within in the mobile packet communication network 10.

The GWS 5 is a computer-based system that may operate provided with a mobile packet gateway switching station. The GWS 5 may for interconnecting the mobile packet

communication network 10 with another network such as the Internet 6. As shall be explained below later, this the GWS 5 may also maintain a wireless communication link path (a radio-oriented interval) between the ~~is for connecting a~~ radio-oriented interval from the MS 1 and the GWS 5. In addition, a wireline communication link path (a wire-oriented interval or landline communication link path) may be maintained by the GWS 5 between the GWS 5 and the ~~to~~ itself and a wire-oriented interval from itself to the CPS 8. Accordingly, the GWS 5 operates as a relay between the MS 1 and the CPS 8. Additionally, a plurality of the GWS 5 may form a server group. A proxy server may also be included in the server group. Further, the GWS 5 may and performs perform various types of control to enable packet communications between the MS 1 and CPS 8.

Enabling packet communications involves translation by absorbing differences between the simplified protocol (hereafter called TL, a first communication protocol and a second communication protocol. The first communication protocol is a simplified protocol hereafter referred to as "simplified protocol TL" or "TL". The simplified protocol TL is used in wireless communication links paths within wireless communication networks (radio-oriented interval). The second communication protocol is a server based network communication protocol such as TCP. The second communication protocol is used in wireline communication links paths within wireline (or landline) networks (wire-oriented interval) and is hereafter referred to as "TCP/IP protocol." + used in the radio-oriented interval and TCP which is the protocol in the wire-oriented interval.

Additionally, a plurality of the GWS 5 are provided to form a server group, with a proxy server also contained

~~in this server group.~~

5 The CPS 8 is a server-based system that may be operated by the-a content provider business. The CPS 8 may supply, and supplies the GWS 5 with content. The content may the information to be provided to the users of the MS 1 in a content format such as HTML data format. The content may be provided via the Internet~~internet~~ 6 or a dedicated line 7.

10 ~~Additionally~~In addition, the GWS 5 may include itself contains a server for the mobile packet communication network 10 business to provide content to the MS 1.

15 The M-SCP 9 may manages subscriber information and performs processing relating to packet registration. When when packet communications begins, packet registration may be performed by the M-SCP 9. When packet communication ends, as shall be explained, and packet deregistration may be performed by the M-SCP 9. when packet communications end.

20 ~~Billing information for the packet communications are~~ may be recorded in the PPM 3 and the GWS 5. The billing information may be and transferred at a predetermined timing to a billing center such as a call toll accounting center~~center~~ which is (not shown).

25 1.2. Protocol Structure

In the above-described communication system, the devices employ the protocol structures described below in order to perform data communications between the MS 1 and the CPS 8.

30 Figs. 2 and 3 express schematically the example protocol structures of the present embodiment based on an OSI layer model. Here, Fig. 2 shows a protocol structure for a case where information is received from the CPS 8 by

the mobile station (MS 1) alone, and Fig. 3 shows a protocol structure for a case where information is received from the CPS 8 by ~~in a structure where~~ an external device 11, such as a portable information terminal or car navigation device, ~~that is coupled with~~ attached to the MS 1 is associated therewith.

In the example protocol structures shown in Figs. 2 and 3, the left side of the GWS 5, i.e. the PPM 3 and the MS 1 (and external device 11) are in wireless communication or in the radio-oriented data communication interval, wherein With In a wireless communication link-path, a radio communication protocol and the simplified protocol TL of the present embodiment are used. On the other hand, the right side of the GWS 5, i.e. up to the CPS 8 is a wire line communication link-path or the wire-oriented communication interval, wherein In the wire line communication link-path, the general-purpose protocol TCP/IP (second communication protocol) is used.

Thus, ~~t~~ The example protocol structure shown in Figs. 2 and 3 shall now be described in sequence from the bottom layers to a top layer based on an the OSI layer model.

1.2.1. First Layer (Physical Layer)

In Figs. 2 and 3, L1 indicates a physical layer protocol.

In the physical layer protocol of the wire-line communication link-path (wire-oriented interval), the used frequencies used, transmission power, modulation method, access method and other wire line-related communication parameters the like are defined. The wire line-related communication parameters are defined in order to ensure that the transmission of bit sequences is performed using communication lines composed of physical media such as dedicated lines, public telephone lines or ISDN.

On the other hand, in the physical layer protocol of the wireless communication link-path (radio-oriented interval), the packet communication channels are defined on the basis of the channel structure of the ~~PDC system~~, and in particular, mobile packet communication network 10 (FIG. 1), such as a personal digital communication (PDC) system. The arrangement/structure of physical channels for packet communication, and the signal coding method and signal transmission method for transmitting signals using the physical channels for packet communication are defined.

1.2.2. Second Layer (Data Link Layer)

In Figs. 2 and 3, L2 indicates a data link layer protocol.

In the data link layer protocol of the wire-line communication link-path (wire-oriented interval), the procedures and interfaces for performing transparent and highly reliable data transmissions between nodes are defined. The procedures and interfaces may be defined using bit sequence transmission functions provided in the physical layer. Data links are established using PPP as the protocol of this data link layer.

On the other hand, in the data link layer protocol of the wireless communication link-path (radio-oriented interval), LAPDM (Link Access Procedure for Digital Mobile channel) is used between the MS 1 and PPM 3. This—The LAPDM is one—used for physical control channels and physical communication channels with functions added to perform packet communications efficiently so as to enable use on physical channels for packet communications.

Furthermore, in the case of Fig. 3, an LAPB (Link Access Procedure Balanced) is used between the MS 1 and the external device 11.

1.2.3. Third Layer (Network Layer)

5 The network layer protocol in the wireless communication linkpath (wire-oriented interval) is composed of an IP (Internet Protocol). This IP performs routing and supplies HTML data transmitted from the CPS 8 to the GWS 5 via the Internet 6.

10 Additionally, in the wireless communication link-path (radio-oriented interval), PMAP (Packet Mobile Application Part) ~~is~~may be used between the PPM 3 and GWS 5. This ~~The~~ PMAP is defined as a signal message format for transmitting and receiving user packets between nodes in a PDC-P network.

15 The network layer protocol for communications between the MS 1 and the PPM 3 ~~may be~~is composed of RT (Radio frequency Transmission management), MM (Mobility Management) and CC (Call Control).

20 15 Here, RT ~~achieves~~performs functions relating to management of radio resources (including management of physical channels for packet communications). including In addition, such functions as selection of radio zones and ~~as~~ setting, maintenance, switching and disconnection of radio channels are performed by RT. MM ~~achieves~~performs functions relating to mobile station (MS 1) movement support, including The functions include position registration and identification. functions, and CC ~~achieves~~performs functions relating to channel call connection control. including Such functions as include setting, maintenance and release of calls. The detailed operations of these network layer protocol functions are described in "Digital Car Telephone System Standards RCR STD-27F".

30 25 These functions work cooperatively to perform such control as simultaneous standby control, communication initiation control, packet transfer control, channel switching control, periodic registration control and communication termination control.

1.2.4. Fourth Layer (Transport Layer)

The transport layer protocol of the wire-line communication linkpath (wire-oriented interval) is composed of TCP. This The transport layer protocol is for supplying HTML data transmitted from the CPS 8 to the GWS 5 via the Internet 6.

Additionally, The transport layer protocol is also for communications between the MS 1 and GWS 5 in—over the wireless communication linkpath (radio-oriented interval).

The transport layer protocol over the wireless communication linkpath is composed of the simplified protocol TL. This The TL provides a connection-type service for performing highly reliable end-to-end communications, making that make communications by virtual circuits possible. As a result, higher level applications can provide dialog-type services as if a physical point-to-point link has been established with a communication partner (this is known as a "logical connection").

Additionally, this The TL can set up a plurality of logical connections simultaneously. The communication protocol of the mobile packet communication network 10 (FIG. 1) is composed in such a way that the TL directly resides on the bearer of the mobile packet communication network 10.

1.2.5. Fifth Layer (Session Layer)

In Over the wire-line communication linkpath (wire-oriented interval), HTTP is—may be used for browser display. In addition, and SMTP is—may be used for electronic mail distribution. HTTP and SMTP may be used on the session layer and presentation layer between the GWS 5 and the CPS 8.

Between the MS 1 and the GWS 5, communications are may be performed using HTTP by means of a virtual circuit to be that is explained below later. Additionally In addition,

in the application layer, data communications are performed between the MS 1 having operating a browser and the CPS 8 possessing data of various formats such as plain text, HTML, GIF, and the like.

5 1.2.6. Sixth Layer (Presentation Layer)

Between the MS 1 and GWS 5, ~~t~~The sixth layer is composed of may include HTTP as an Internet work-dedicated protocol, between the MS 1 and the GWS 5. between Between the GWS 5 and the CPS 8, it is composed of the sixth layer may include HTTP/SMTP protocols.

10 1.2.7. Seventh Layer (Application Layer)

The application layer of the MS 1 is composed of a browser having the function of internet Internet browsing software, and tThe application layer of the CPS 8 which provides the user of the MS 1 with various information is composed of includes data such as plain text, HTML, GIF, and the like. As previously discussed, the CPS 8 operates as a server to provide the user of the MS 1 with various content.

20 2. Operation of the Embodiment

The overall operating sequence of a communication system including the wire-line communication link-path (wire-oriented interval) and wireless communications linkpath (radio-oriented interval) employing a protocol structure of this type shall be explained for the case of performing packet communications. In the following description, the structures of the packets exchanged in the wireless communication link-path (radio-oriented intervals) shall be referred to as the "occasion demands." In addition, it should be understood that each of the packets are transmitted in the form of a signals- that are each messages.

2.1. Operating Sequence for Packet Registration

When a user presses the "information" key in MS 1, the operating sequence for packet registration shown in Fig. 4 is executed.

5 First, At S100, a packet communication registration request is issued from the MS 1 side toward the PPM 3 in the form of a message(or signal) (S100). Upon receiving this the registration request, the PPM 3 sends the GWS 5 a signal message requesting readout of packet origination 10 information at S101. The packet origination information indicating indicates whether or not the packet originator is a packet subscriber (S101). This The packet origination information readout request signal message is transmitted through the GWS 5 to the M-SCP 9 (S102).

15 The M-SCP 9 searches for subscriber information corresponding to the an originator ID contained included in the packet origination information readout request signal message to determine whether or not the user of MS 1 is a packet service subscriber, and sends out a packet 20 origination information readout response signal message at (S103). Then At S104, this the packet origination information readout response signal message is transmitted through the GWS 5 to the PPM 3 (S104).

25 Upon receiving this the packet origination information readout response message, the PPM 3 sends the MS 1 a packet identification request signal message at (S105). At S106, a packet identification response signal message with respect in response to this the packet identification request signal is returned from the MS 1 to the PPM 3 30 (S106).

Next, A packet communication registration request signal message requesting registration of packet communications is transmitted from the PPM 3 through the

GWS 5 to the M-SCP 9 at {S107→} and S108. At S109, ~~t~~he M-SCP 9 performs registration for initiating packet communication between the MS 1 and the ~~wireless~~ wireless communication system, and returns a 5 packet communication registration response ~~signal~~ message to the GWS 5 (S109). Then, ~~this~~ packet communication registration request ~~signal~~ message is transmitted from the GWS 5 to the PPM 3 at {S110}.

Upon receiving ~~this~~ the packet communication 10 registration response ~~signal~~ message, the PPM 3 sends a channel connection request ~~signal~~ message requesting channel connection to the GWS 5 at {S111}. Receiving ~~this~~ At S112, the GWS 5 receives the channel connection 15 request ~~message~~ signal and sends a channel connection request ~~message~~ signal to the CPS 8. (S112), and ~~t~~he CPS 8 returns a channel connection response ~~message~~ signal at {S113}.

Upon receiving the channel connection response 20 ~~message~~ signal, the GWS 5 sends the PPM 3 a channel connection request ~~response~~ message ~~signal~~ at {S114}, and At S115, the PPM 3 sends the MS 1 a packet communication registration response ~~message~~ signal (S115).

2.2. Operating Sequence during Packet Communications

When ~~this~~ the sequence of packet communication 25 registration procedures ends, an initial screen such as the example shown in the previously mentioned discussed Fig. 11 is shown in the information display portion 1a of MS 1. Then, ~~when~~ the user may then operates at the jog dial key 1c 30 and selects a menu number from the initial screen. Packet communications may are then commenced to display the content of the homepage at the URL linked to that menu number on the information display portion 1a.

Fig. 5 shows the an example operating sequence during packet communications.

5 First At S200, the MS 1 sends out a first packet (TL-OpenReq packet), "first packet" in the claims) containing The first packet includes a connection setup request message (Open Request), the URL of the homepage which is to be accessed, and an HTTP-Get method. The HTTP-Get method is requesting transfer of the data required to display the content of the homepage on the information display portion 10 1a of the MS 1 (S200).

Fig. 8 shows the structure of the an example TL-OpenReq packet sent when requesting connection setup in the example of FIG. 5. In this packet, the field indicating the type of message contains identified as "message type" 15 includes information indicating that the message type is an "Open Request" message, and the field for identified as "data" contains data for the HTTP-Get method including the above-mentioned URL. The "logical number" field contains identification numbers for identifying the end-to- 20 end connection established between the MS 1 and the GWS 5. The simplified protocol TL in the wireless communication linkpath (radio-oriented interval) enables a plurality of simultaneous logical connections, each Each logical connection being is indicated identified by means of this in 25 the field identified as "logical number." This the logical number field is set on the mobile station side (MS1).

30 Additionally, the fields indicating identified as "communication parameters" contains the data length and the number of units amount of data that capable of being received at once by the MS 1 can receive in one packet., as well as In addition, information such as timer values for the case where retransmission is to be performed may be included in the communication parameters fields. That is,

the The MS 1 may store houses information relating to its own capabilities in the communication parameter fields of the transfer packet to be sent to the wireline network side.

5 This As shown in FIG. 5, the TL-OpenReq packet may
beis sent through the PPM 3 to the GWS 5 at (S201). Upon
receiving this, the The GWS 5 returns a TCP acknowledgement
response packet and a packet containing an acknowledgement
response message (Open Acknowledge TL-OpenAck) with respect
to the MS 1 TL Open Request is returned to through the PPM 3
10 (S202, S203, S205).

That isMore specifically, on the wireline network side, a logical connection setup request message is received.-, the communication parameter information for the MS 1 side is analyzed.-, and the The communication parameters at logical connection setup are determined and sent out, together with the acknowledgement response message (Open Acknowledge).

20 In this way, with With the simplified protocol TL, the capabilities of the partner side (the above-mentioned communication parameter values) of the MS 1 and the GWS 5 (the partner sides) are negotiated before setting up the logical connection and prior to data exchange.-, so that Thus, resources are used efficiently, and capacity control is performed by traffic gradients.

25 Then, a logical connection is then established between the MS 1 and the GWS 5 by means of these operations, and the exchange of packet data is completed.

Fig. 9 shows the structure of an example TL-OpenAck packet sent as an acknowledgement response to a connection setup request message in the example of FIG. 5. In this the TL-OpenAck packet, the field indicating identified as the "message type" contains information indicating that it is an "Open Acknowledge" message.-, and the The field

identified as "logical number" field contains logical numbers designated at the time of the connection setup request.

5 Then, this Referring again to FIG. 5, the TL-OpenAck packet is transferred to the mobile station side (MS 1) at {S205}, and the TCP acknowledgment response packet is transferred from the PPM 3 to the GWS 5 (S204).

10 On the other hand, the following type of exchange occurs between the GWS 5 (which has received the TL-OpenReq packet) and the CPS 8 based on the normal TCP operating sequence.

15 First, At S206, in order to establish a connection between the GWS 5 and the CPS 8, a segment to which a SYN flag has been set is sent from the GWS 5 to the CPS 8. (S206), and as As an acknowledgment response to indicate that the segment has been received, a segment with an SYN flag and an ACK flag is returned from the CPS 8 to the GWS 5 at {S207}. Then At S208, a segment having an ACK flag is sent from the GWS 5 to the CPS 8 (S208). A connection is 20 established between the GWS 5 and the CPS server 8 by means of this a Three Way Handshake procedure that is part of the TCP.

25 Next At S209, an HTTP-Get segment containing the URL of the target homepage (obtained from MS 1 in step S201) is transmitted from the GWS 5 to the CPS server 58. (S209), and the The CPS 8 returns an acknowledgment response signal indicating that the HTTP-Get segment has been received to by the GWS 5 at {S210}.

30 Then At S211, an HTTP-Res segment containing data from the homepage in of CPS 8 as designated by the URL is transmitted from the CPS 8 to the GWS 5. (S211), and a A segment with an ACK flag indicating that the HTTP-Res segment has been received is returned from the CPS 8 at

{S212}.

When data transfer by the HTTP-Res segment ends, the following type of connection termination process is performed.

5 First At S213, a segment set up with a FIN flag is sent from the CPS 8 to the GWS 5. —(S213). The GWS 5 returns an acknowledgment response segment indicating that this the segment has been received at {S214}. Then At, this time, a similar connection termination process is performed
10 from the GWS 5 at {S215, and S216}.

By means of this sequence composed of the 11 steps of steps S206-S216, data from the homepage in of the CPS 8 is supplied to the GWS 5.

15 Next, a A packet (TL-DATA packet) containing data from the homepage in of the CPS 8 previously supplied to the GWS 5 is transferred to the PPM 3 at {S217}.

20 In Fig. 10, this an example TL-DATA packet is indicated as packet 10A, and its structure is shown. In this packet 10A, the field indicating identified as the "message type" contains information indicating that the message type is a "Data" message. — and the The fields identified as "data" field contains includes the data from the homepage in of the CPS 8.

25 Referring again to FIG. 5, A TCP acknowledgment response packet indicating that this packet has been received is returned from the PPM 3 to the GWS 5 (S218). Then, the TL-DATA packet transferred to the PPM 3 is then transferred to the MS 1 at {S219}. As a result, data from the homepage designated selected by the user is transferred
30 to the MS 1— and the The content corresponding to the menu number selected from the initial screen 11A (FIG. 11) by the user is displayed on the information display portion
1a.

Then, the MS 1 returns an acknowledgment response packet (TL-DATA Ack packet) to the PPM 3 indicating that the TL-DATA packet has been received to the PPM 3 at (S220).

5 In Fig. 10, this the TL-DATA Ack packet is shown as packet 10B, and its structure is shown. In this packet 10B, the field identifying identified as the "message type" contains includes information indicating that the message type is "Data Acknowledge".

10 Referring again to FIG. 5, the TL-DATA Ack packet returned to the PPM 3 is transferred to the GWS 5 at (S221), and a TCP acknowledgment response packet indicating that this the TL-DATA Ack packet has been received is returned to the PPM 3 (S222).

15 While the The example above explained above example is one wherein data transfer ends after a single packet transferred from the CPS 8 to the MS 1. In actual practice, the sequences between the PPM 3 and GWS 5 (S217, S218, S221, S222) and the sequences between the MS 1 and PPM 3 (S219, S220) are repeatedly performed in accordance 20 with the amount of data supplied from the CPS 8. That is, if the amount of data supplied from the CPS 8 is 3 times the maximum amount of data capable of being received at once in one packet on the MS 1 side, then the data is divided and transferred to the MS 1 side in 3 25 divisions packets. The processes of steps S217, S218, S221 and S222, and steps S219 and S220 are therefore performed 3 times.

2.3. Operating Sequence at Packet Communication

30 Termination

Fig. 6 shows an example of the operating sequence process at the time of packet communication termination.

First, a signal which message requests requesting

deregistration from packet communications is transmitted from the MS 1, through the PPM 3 and GWS 5 to the M-SCP 9 at (S300, H-S301 H-and S302). At S303, the M-SCP 9 deregisters MS 1 from packet communications, and sends a 5 packet communication deregistration signal-response message (S303). This The packet communication deregistration signal-response message is transmitted via the GWS 5 and PPM 3 to the MS 1 at (S304 H-and S305), and upon receiving it At S306, the MS 1 sends the PPM 3 a 10 response signal with respect to message acknowledging receipt of the packet communications deregistration signal-response message (S306).

Next, the The PPM 3 sends the GWS 5 a signal message requesting disconnection of the channel at (S307), and At S308, the GWS 5 sends the CPS 8 the channel disconnection request signal message (S308). Upon receiving this the channel disconnection request message, the CPS 8 sends the GWS 5 a channel disconnection response signal message at (S309), and At S310, the GWS 5 sends the PPM 3 a channel disconnection response signal message (S310), thus ending 20 the sequence process performed at packet communications termination.

3. Effects of the Embodiment

25 (1) In this way, by comparing the conventional sequence using PPP, IP and TCP (shown in Fig. 15) with the sequence using TL between the MS 1 and GWS 5 (shown in Fig. 5) of the present embodiment, it is possible to largely reduce (to about 1/3) the number of messages (signals) exchanged between the transmitting side and the receiving side., and to smoothly perform As a result, data communications may be smoothly performed even if the hardware spees performance (CPU processing power, memory capacity, etc.)

of the MS 1 are not very high relatively low.

(2) Additionally, as shown in Fig. 7, the structure of the packet 7B transferred in the present embodiment with the simplified protocol TL is considerably simplified. That is, in communications by the simplified protocol TL, each packet is composed of a header of approximately 10 bytes (called the TL header) and application data (e.g. about 500 bytes, expandable to a maximum of about 1400 bytes).

Consequently, the header size is largely reduced (to about 1/5) in comparison to conventional packets 7A using TCP/IP.

As a result, the amount of transferred data is reduced and the communication cost is time and bandwidth requirements are also lowered.

15 4. Examples of Modifications

The present invention is not restricted to the above-described embodiments, and various modifications such as the examples given below are possible.

(1) While data communications downstream with respect to the network was have been previously described in the present embodiment from the viewpoint of the user of a mobile station (MS 1) receiving data distributions from a CP server (CPS 8). It is also possible to transfer data according to the previously described communication simplified protocol (TL) described in the present embodiment in data communications upstream. That is, data communications by TL are possible in cases where electronic mail is to be transmitted to a partner terminal connected to the internet Internet.

(2) The previously described communication simplified protocol (TL) described in the present embodiment is no more than a single one example of a simplified protocol. It can be any protocol that does not have a relatively high

signal number of messages such as the in conventional TCP/IP, is may be connected to the communication partner by a virtual circuit at the transport layer level, and allows for connection-type communications.

5 (3) The structure of the packets and content of the information elements described in the present embodiment are only examples, and Therefore these structures and content may be of any type which allows the header size to be made smaller, and enables smooth data communications
10 between the user terminal (MS 1) and the relay apparatus (CPS 8).

15 (4) The format of the data distributed from the CP server does not need to be HTML, and other formats may be employed. For example, if the distributed information is only text data, then it does not have to be a data format which uses browser-compatible tags such as HTML.

20 (5) The GWS 5 can be composed of a plurality of devices, such as to spread the load and traffic on the GWS 5. For example, as shown in Fig. 16, it can be separated into an M-PGW (Mobile Message-Packet Gateway Module) 11 and a GWS 13, such that In this example, the GWS 13 performs relay processes between the mobile packet communications network 10 and external communication paths, and the M-PGW 12 performs other processes. Additionally In addition, it is
25 possible to provide a plurality of M-PGW 11 and connect each M-PGW 11 to the GWS 13, so as to spread the load and traffic on each M-PGW.

30 While the present invention has been described with reference to specific exemplary embodiments, it will be evident that various modifications and changes may be made to these embodiments without departing from the broader spirit and scope of the invention as set forth in the claims. Accordingly, the specification and drawings are to

be regarded in an illustrative rather than a restrictive sense.

ABSTRACT OF THE DISCLOSURE

5 The present invention has the purpose of providing technology capable of efficiently transmitting data when performing data communications between a mobile station and a server apparatus.

10 In the present invention, a A simplified protocol TL is employed on the transport layer instead of TCP/IP. The simplified protocol TL is used as the communication protocol on the a wireless communication link path (radio-oriented interval) between an MS (Mobile Station) 1 and a GWS (GateWay Server) 5. which The simplified TL protocol is utilized to relays data communications between the MS 1 and a CPS 8 (Content Provider Server). Additionally, the 15 headers of the packets for data transfer according to TL are made up of about 10 bytes. By doing so, the traffic between the MS 1 and GWS 5 is decreased and the overhead is reduced in comparison to when TCP/IP is employed, thus improving the response of the data communications. The 20 response of data communications is therefore improved by a decrease in traffic between the MS 1 and the GWS 5 and reduction in overhead in comparison to when TCP/IP is deployed. As a result, the user can comfortably efficiently access contents provided by the CPS 8 on over 25 the internet Internet via a wireless communication link path. radio oriented interval which Efficient access may occur even where the wireless communication link path has a low data transmission capacity in comparison to a wire- oriented line interval communication link path. In addition, 30 efficient access may occur where the user is using an MS 1 which has insufficient data processing power to employ deploy TCP/IP.